

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-105. Canceled.

106. (New) A method for supporting establishment of a requested connection between a node of an inside address realm and a node of an outside address realm through an intermediate communication gateway having a gateway address pool comprising a limited number of available outside-realm gateway addresses for enabling outside-realm representation of inside-realm nodes, said method comprising the steps of:

i) providing multiplexing information including at least one of network address information and port information of at least one of said inside-realm node and said outside-realm node;

ii) performing, prior to initiating establishment of said requested connection, network address allocation including the steps of:

selecting, from said gateway address pool, a candidate outside-realm gateway address for combination with said multiplexing information,

determining whether the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for another connection;

repeating, if the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for another connection, the selecting step until a unique combination is found that is not already being utilized for another connection; and

iii) thereafter, initiating establishment of said requested connection based on the unique combination of outside-realm gateway address and said multiplexing information.

107. (New) The method according to claim 106, wherein the unique combination of outside-realm gateway address and said multiplexing information defines an outside-realm gateway state representation that has no counterpart in a predetermined set of existing gateway connection states.

108. (New) The method according to claim 107, further comprising the step of maintaining a separate list representation of said predetermined set of existing gateway connection states, and wherein said outside-realm gateway state representation is selected based on comparison with corresponding information of said gateway connection states represented in said list representation.

109. (New) The method according to claim 107, wherein said multiplexing information, for an inside-realm initiated connection, includes at least one of outside node address information and outside node port information, said outside-realm gateway state representation is an at least partially complete gateway state representation, and said predetermined set of gateway connection states includes the existing gateway connection states in said gateway.

110. (New) The method according to claim 109, wherein said selecting step also includes selecting associated gateway port information for combination with said multiplexing information, said outside-realm representation is a complete outside-realm representation, and said

step of initiating establishment of said connection comprises the step of requesting that said gateway creates a gateway connection state based on said complete outside-realm representation.

111. (New) The method according to claim 109, wherein said outside-realm representation is a partially complete outside-realm representation, and said step of initiating establishment of said connection comprises the step of requesting that said gateway creates a partially complete gateway connection state based on said partially complete outside-realm representation.

112. (New) The method according to claim 107, wherein said multiplexing information, for an outside-realm initiated connection, includes at least one of outside node address information and inside node port information, said outside-realm gateway state representation is a partially complete gateway state representation and said predetermined set of gateway connection states includes the existing partially complete gateway connection states in said gateway.

113. (New) The method according to claim 112, wherein outside-realm gateway addresses of the gateway are traversed until finding an outside-realm gateway address, which in combination with said multiplexing information has no counterpart in any existing partially complete gateway connection state.

114. (New) The method according to claim 112, wherein said step of determining whether the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for a connection comprises the step of verifying

that a pre-allocated outside-realm gateway address in combination with said multiplexing information has no counterpart in any existing partially complete gateway connection state.

115. (New) The method according to claim 112, wherein said step of initiating establishment of said connection comprises the step of requesting that said gateway establishes a partially complete gateway connection state based on said partially complete outside-realm representation.

116. (New) The method according to claim 115, further comprising the step of transforming, upon receipt of a packet from said outside node to said gateway, said partially complete gateway connection state that has been created in said gateway into a complete gateway connection state based on complementary connection information associated with said packet.

117. (New) The method according to claim 116, wherein said multiplexing information is predetermined outside node address information, and said complementary connection information includes inside node port information and outside node port information.

118. (New) The method according to claim 116, wherein said multiplexing information is predetermined inside node port information, and said complementary connection information includes outside node address information and outside node port information.

119. (New) The method according to claim 112, further comprising the steps of:

- selecting, if it is not possible to find a unique combination based on predetermined inside node port information, another gateway port; and
- selecting an outside-realm gateway address based on said selected gateway port to define a unique, partially complete outside-realm representation of a gateway connection state.

120. (New) The method according to claim 112, wherein said multiplexing information originates from a user-resource identifier query initiated from said outside node.

121. (New) The method according to claim 107, wherein said connection establishment is based on said outside-realm gateway state representation and a corresponding inside-realm gateway state representation.

122. (New) The method according to claim 106, further comprising the steps of:

- preparing, at said outside node, a user-resource identifier query that includes an inside node identifier as well as said multiplexing information including at least one of outside node address information and inside node port information;
- determining inside-realm network address information based on said inside node identifier included in said identifier query;
- selecting, based on said multiplexing information included in said identifier query, said outside-realm gateway address to be used in establishing a dynamic gateway connection state for a flow between said outside node and said inside node through said gateway; and

establishing said dynamic gateway connection state based on said selected outside-realm gateway address, said multiplexing information included in said identifier query and said inside-realm network address information, thereby enabling an outside-realm initiated connection.

123. (New) The method according to claim 122, wherein said step of establishing said dynamic gateway connection state comprises the steps of:

creating a partially complete gateway connection state based on said selected outside-realm gateway address, said multiplexing information included in said identifier query and said inside-realm network address information; and

upon receipt of a packet from said outside node to said gateway, transforming said partially complete gateway state into a complete gateway connection state based on complementary connection information associated with said packet.

124. (New) The method according to claim 122, wherein said step of selecting an outside-realm gateway address comprises the step of selecting an outside-realm gateway address, which in combination with said multiplexing information included in said identifier-query defines a partially complete outside-realm gateway state representation that has no counterpart in any existing partially complete gateway connection state.

125. (New) The method according to claim 124, further comprising the step of maintaining a separate list representation of existing partially complete gateway connection states, and wherein said partially complete outside-realm representation is allocated based on comparison

with corresponding information of all existing partially complete gateway connection states represented in said list representation.

126. (New) The method according to claim 125, wherein outside-realm gateway addresses associated with said gateway are traversed until finding an outside-realm gateway address, which in combination with said multiplexing information included in said identifier query has no counterpart in any existing partially complete gateway connection state represented in said list representation.

127. (New) The method according to claim 125, wherein said step of determining whether the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for a connection comprises the step of verifying that a pre-allocated outside-realm gateway address in combination with said multiplexing information included in said identifier query has no counterpart in any existing partially complete gateway connection state represented in said list representation.

128. (New) The method according to claim 123, wherein said multiplexing information included in said identifier query is an outside network address of said outside node, and said complementary connection information for completing the gateway connection state includes a port number of said inside node and a port number of said outside node.

129. (New) The method according to claim 123, wherein said multiplexing information included in said identifier query is an inside node port number, and said

complementary connection information for completing the gateway connection state includes an outside network address of said outside node and a port number of said outside node.

130. (New) The method according to claim 122, further comprising the step of notifying said outside node of said selected outside-realm gateway address.

131. (New) The method according to claim 122, wherein said user-resource identifier query is a Domain Name Server (DNS) query.

132. (New) The method according to claim 122, wherein said inside address realm is a private address realm and said outside address realm is a public address realm.

133. (New) A device for supporting establishment of a requested connection between a node of an inside address realm and a node of an outside address realm through an intermediate communication gateway having a gateway address pool comprising a limited number of available outside-realm gateway addresses for enabling outside-realm representation of inside-realm nodes, said device comprising:

- i) means for providing multiplexing information including at least one of network address information and port information of at least one of said inside-realm node and said outside-realm node;
- ii) means for network address allocation, said network address allocation means being configured, prior to initiating establishment of said requested connection, for:

selecting, from said gateway address pool, a candidate outside-realm gateway address for combination with said multiplexing information,

determining whether the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for another connection;

repeating, if the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for another connection, the selection of outside-realm gateway address until a unique combination is found that is not already being utilized for another connection; and

iii) means for initiating establishment of said requested connection based on the unique combination of outside-realm gateway address and said multiplexing information.

134. (New) The device according to claim 133, wherein said network address allocation means is configured for finding a unique combination of outside-realm gateway address and said multiplexing information defining an outside-realm gateway state representation that has no counterpart in a predetermined set of existing gateway connection states.

135. (New) The device according to claim 134, further comprising means for maintaining a separate list representation of said predetermined set of existing gateway connection states, and wherein said network address allocation means is configured for finding said outside-realm gateway state representation based on comparison with corresponding information of said gateway connection states represented in said list representation.

136. (New) The device according to claim 134, wherein said multiplexing information, for an inside-realm initiated connection, includes at least one of outside node address information and outside node port information, said outside-realm gateway state representation is an at least partially complete gateway state representation, and said predetermined set of gateway connection states includes the existing gateway connection states in said gateway.

137. (New) The device according to claim 136, wherein said network address allocation means is configured for selecting also associated gateway port information for combination with said multiplexing information, said outside-realm representation is a complete outside-realm representation, and said means for initiating establishment of said connection comprises means for requesting that said gateway creates a gateway connection state based on said complete outside-realm representation.

138. (New) The device according to claim 136, wherein said outside-realm representation is a partially complete outside-realm representation, and said means for initiating establishment of said connection comprises means for requesting that said gateway creates a partially complete gateway connection state based on said partially complete outside-realm representation.

139. (New) The device according to claim 134, wherein said multiplexing information, for an outside-realm initiated connection, includes at least one of outside node address information and inside node port information, said outside-realm gateway state representation is a partially

complete gateway state representation and said predetermined set of gateway connection states includes the existing partially complete gateway connection states in said gateway.

140. (New) The device according to claim 139, wherein said network address allocation means is configured for traversing outside-realm gateway addresses of the gateway until finding an outside-realm gateway address, which in combination with said multiplexing information has no counterpart in any existing partially complete gateway connection state.

141. (New) The device according to claim 139, wherein said means for determining whether the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for a connection comprises means for verifying that a pre-allocated outside-realm gateway address in combination with said multiplexing information has no counterpart in any existing partially complete gateway connection state.

142. (New) The device according to claim 139, wherein said means for initiating establishment of said connection comprises means for requesting that said gateway establishes a partially complete gateway connection state based on said partially complete outside-realm representation.

143. (New) The device according to claim 142, further comprising means for transforming, upon receipt of a packet from said outside node to said gateway, said partially complete gateway connection state that has been created in said gateway into a complete gateway connection state based on complementary connection information associated with said packet.

144. (New) The device according to claim 143, wherein said multiplexing information is predetermined outside node address information, and said complementary connection information includes inside node port information and outside node port information.

145. (New) The device according to claim 143, wherein said multiplexing information is predetermined inside node port information, and said complementary connection information includes outside node address information and outside node port information.

146. (New) The device according to claim 139, further comprising means for selecting, if it is not possible to find a unique combination based on predetermined inside node port information, another gateway port, and means for selecting an outside-realm gateway address based on said selected gateway port to define a unique, partially complete outside-realm representation of a gateway connection state.

147. (New) The device according to claim 139, wherein said multiplexing information originates from a user-resource identifier query initiated from said outside node.

148. (New) The device according to claim 134, wherein said means for initiating establishment of said connection is configured to operate based on said outside-realm gateway state representation and a corresponding inside-realm gateway state representation.

149. (New) The device according to claim 134, further comprising:

means, responsive to a user-resource identifier query from said outside node, for determining inside-realm network address information based on an inside node identifier included in said identifier query, wherein said identifier query further includes said multiplexing information including at least one of outside node address information and inside node port information;

means for selecting, based on said multiplexing information included in said identifier query, said outside-realm gateway address to be used in establishing a dynamic gateway connection state for a flow between said outside node and said inside node through said gateway; and

means for establishing said dynamic gateway connection state based on said selected outside-realm gateway address, said multiplexing information included in said identifier query and said inside-realm network address information, thereby enabling an outside-realm initiated connection.

150. (New) The device according to claim 149, wherein said means for establishing said dynamic gateway connection state comprises:

means for creating a partially complete gateway connection state based on said selected outside-realm gateway address, said multiplexing information included in said identifier query and said inside-realm network address information; and

means for transforming, upon receipt of a packet from said outside node to said gateway, said partially complete gateway state into a complete gateway connection state based on complementary connection information associated with said packet.

151. (New) The device according to claim 149, wherein said means for selecting an outside-realm gateway address is operable for selecting an outside-realm gateway address, which in combination with said multiplexing information included in said identifier-query defines a partially complete outside-realm gateway state representation that has no counterpart in any existing partially complete gateway connection state.

152. (New) The device according to claim 151, further comprising means for maintaining a separate list representation of existing partially complete gateway connection states, and wherein said network address allocation means is configured for finding said partially complete outside-realm representation based on comparison with corresponding information of all existing partially complete gateway connection states represented in said list representation.

153. (New) The device according to claim 152, wherein said network address allocation means is configured for traversing outside-realm gateway addresses associated with said gateway until finding an outside-realm gateway address, which in combination with said multiplexing information included in said identifier query has no counterpart in any existing partially complete gateway connection state represented in said list representation.

154. (New) The device according to claim 152, wherein said means for determining whether the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for a connection comprises means for verifying that a pre-allocated outside-realm gateway address in combination with said multiplexing

information included in said identifier query has no counterpart in any existing partially complete gateway connection state represented in said list representation.

155. (New) The device according to claim 150, wherein said multiplexing information included in said identifier query is an outside network address of said outside node, and said complementary connection information for completing the gateway connection state includes a port number of said inside node and a port number of said outside node.

156. (New) The device according to claim 150, wherein said multiplexing information included in said identifier query is an inside node port number, and said complementary connection information for completing the gateway connection state includes an outside network address of said outside node and a port number of said outside node.

157. (New) The device according to claim 149, further comprising means for notifying said outside node of said selected outside-realm gateway address.

158. (New) The device according to claim 149, wherein said user-resource identifier query is a Domain Name Server (DNS) query.

159. (New) The device according to claim 149, wherein said inside address realm is a private address realm and said outside address realm is a public address realm.

160. (New) A gateway resource manager for a communication gateway that has a limited number of available outside-realm gateway addresses for enabling outside-realm representation of inside-realm nodes, said gateway resource manager comprising:

i) an input configured to receive multiplexing information including at least one of network address information and port information of at least one of said inside-realm node and said outside-realm node;

ii) network address allocation circuitry configured to perform the following tasks prior to initiating establishment of a requested connection:

select, from said outside-realm gateway addresses, a candidate outside-realm gateway address for combination with said multiplexing information;

determine whether the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for another connection;

repeat, if the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for another connection, the selection of outside-realm gateway address until a unique combination is found that is not already being utilized for another connection; and

iii) resource allocation circuitry configured to initiate establishment of said requested connection based on the unique combination of outside-realm gateway address and said multiplexing information.

161. (New) The gateway resource manager according to claim 160, wherein said network address allocation circuitry is configured for finding a unique combination of outside-realm

gateway address and said multiplexing information defining an outside-realm gateway state representation that has no counterpart in a predetermined set of existing gateway connection states.

162. (New) The gateway resource manager according to claim 161, wherein said network address allocation circuitry is configured for finding said outside-realm gateway state representation based on comparison with corresponding information of said gateway connection states represented in a list representation of said predetermined set of existing gateway connection states.

163. (New) The gateway resource manager according to claim 161, wherein said multiplexing information, for an inside-realm initiated connection, includes at least one of outside node address information and outside node port information, said outside-realm gateway state representation is an at least partially complete gateway state representation, and said predetermined set of gateway connection states includes the existing gateway connection states in said gateway.

164. (New) The gateway resource manager according to claim 161, wherein said multiplexing information, for an outside-realm initiated connection, includes at least one of outside node address information and inside node port information, said outside-realm gateway state representation is a partially complete gateway state representation and said predetermined set of gateway connection states includes the existing partially complete gateway connection states in said gateway.

165. (New) The gateway resource manager according to claim 161, wherein said input is configured to receive inside-realm network address information corresponding to an inside node, and multiplexing information including at least one of outside node address information and inside node port information;

said outside-realm gateway address is to be used in establishing a dynamic gateway connection state for a flow between said outside node and said inside node through said gateway;

said resource allocation circuitry is configured to request said gateway to establish said dynamic gateway connection state based on said selected outside-realm gateway address, said multiplexing information and said inside-realm network address information.

166. (New) The gateway resource manager according to claim 165, wherein said multiplexing information is an outside node address, and said input is configured to request allocation of said selected outside-realm gateway address to said inside node for traffic coming from said outside node address.

167. (New) The gateway resource manager according to claim 165, wherein said input is configured to send a request to said gateway for establishment of a partially complete gateway connection state based on said selected outside-realm gateway address, said multiplexing information and said inside-realm network address information.

168. (New) The gateway resource manager according to claim 167, further comprising:
means for receiving a reply from said gateway that said partially complete gateway connection state has been created; and

means for notifying said outside node of said selected outside-realm gateway address in response to said reply from said gateway.

169. (New) The gateway resource manager according to claim 167, wherein said network address allocation circuitry is configured to select an outside-realm gateway address, which in combination with said multiplexing information, defines a partially complete outside-realm gateway state representation that has no counterpart in any existing partially complete gateway connection state.

170. (New) The gateway resource manager according to claim 169, further comprising means for maintaining a list representation of existing partially complete gateway connection states, and wherein said network address allocation circuitry is configured to find said partially complete outside-realm representation based on comparison with corresponding information of all existing partially complete gateway connection states represented in said list representation.

171. (New) The gateway resource manager according to claim 160, wherein said network address allocation circuitry is configured to determine whether the combination of the selected candidate outside-realm gateway address and said multiplexing information is already being utilized for a connection based on comparison with established connections and/or connections under establishment.